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ABSTRACT

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MODELING INFLUENCES ON CHILDREN'S CREATIVE BEHAVIOR

by

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and

Frank Dilessi

Abstract

A model's influence on the creative behavior of 120 fifth-grade children was studied in four variations. Separate groups observed a model who was either high or low in the fluency or flexibility creativity dimensions. Multivariate procedures were used to assess treatment effects upon children's fluency and flexibility measures collected on parallel and on a very different type of creative task. High model fluency was found to significantly increase child fluency and flexibility measures on the parallel task. A marginally significant increase in observer fluency was noted on the stringent generalization task. Contrary to predictions, increased model flexibility produced significant decreases in observer fluency and flexibility measures on both the parallel and stringent generalization tasks.

MODELING INFLUENCES ON CHILDREN'S CREATIVE BEHAVIOR[1]

Barry J. Zimmerman and Frank D'Alessi

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Research and Development

Recent research in the social learning tradition has been directed toward concept formation or abstract rule learning issues. For example, observational learning procedures have been found effective in modifying children's abstract class of question formulation (Rosenthal, Zimmerman, & Durning, 1970), in training children to conserve on Piagetian tasks (Rosenthal & Zimmerman, 1972), and in teaching children to select stimuli on the basis of a very complex relational rule (Zimmerman & Rosenthal, in press). Attention in these studies was directed at assessing a child's induction of a superordinate rule governing a model's behavior. From a Guilford (1967) point of view, these studies involved training convergent intellectual processes. No attention to date has been directed at assessing a model's influence upon divergent or creative processes of children.

Guilford (1967) has isolated three major types of creative responses through factor analytic procedures: fluency, flexibility, and originality. Fluency refers to the number of "ideas" produced on a creative task; flexibility describes the number of qualitatively different categories

needed to group the responses; originality was defined as cleverness, remoteness or the statistical infrequency of a particular response to a specific task. Torrance (1966) has developed a test of creative thinking for children which is scored on the basis of one or more of these criteria.

Research studies have isolated some training and social context variables which influence creative behavior. Parnes and Meadow (1959) compared the effects on a creative problem-solving task of instructions to express solutions without evaluation with instructions which required only solutions of good quality (evaluative). They found that significantly more unique and useful responses (quality) were produced in the nonevaluative instruction condition. They found a high correlation between the quality and quantity of ideas produced. While these authors' definition of quality varied somewhat from Guilford's definition of originality, it does suggest that the creative attributes of fluency and originality may not be independent. Indeed, Parnes and Meadow interpreted their findings in support of Osborn's (1957) contention that deferred judgment, or "brainstorming", is necessary for maximal generation of creative ideas.

Wallach and Kogan (1965) and Center and Mackler (1964) showed that children administered creativity tests under relaxed and game-like conditions (no time pressures) produced significantly more original responses than under time-constrained, highly formalized test conditions.

Bandura (1969) has suggested that modeling procedures are particularly well-suited for inducing a subject to perform known responses (an effect

termed facilitation). Debus (1970) and Redberg, Parke, and Hetherington (1971) found that the response tempo of a model influenced the response tempo and number of errors of a child observer on a convergent, problem solving task. It could be expected that the creative fluency of a model would similarly influence the speed and volume of divergent ideas produced by a child observer under similar conditions. Furthermore, the variety of responses (flexibility measure) exhibited by the model could be expected to exert vicarious effects. That is, just as a model's constrained (rule governed) performance has been found to constrain children's attention to certain abstract aspects of conceptual tasks (e.g., the Rosenthal and Zimmerman studies), it can be predicted that unconstrained, highly variable responding by the model might influence a child observer to produce a wider variety of responses during his subsequent performance. It would be of particular interest to determine if vicariously-induced response sets would generalize to a substantially different type of creative task.

METHOD

Subjects and Experimenters

Sixty male and 60 female fifth grade children from two elementary schools in Tucson, Arizona, were selected and randomly assigned to one of four experimental groups, with the restriction that 15 boys and 15 girls appear in each of the experimental conditions. The children were Anglo-Americans of lower middle class background. They ranged in age from 9.9 to 12.3 years, with a mean age of 11.0 years. The male principal investigator served as model, a male graduate student acted as the

experimenter, and a female research associate assisted with proctoring during the study. All adults were Anglo-Americans in their twenties, with no striking departures from average characteristics.

Task and Model's Performance

Four sets of responses were prepared for the Unusual Uses Test (involving cardboard boxes) which was selected from the Torrance Tests of Creative Thinking (1966). The fluency and flexibility characteristics of the model's performance were systematically manipulated according to a 2 x 2 factorial arrangement. The model's responses were selected directly from Torrance's scoring manual, thereby drawing directly from his definitions of fluency and flexibility. In the high fluency-high flexibility condition, 18 responses were selected, three from each of six different categories. According to Torrance's scoring criteria, this performance would be assigned an 18 for fluency and six for flexibility. In the high fluency-low flexibility condition, 18 responses were selected from only one category. In the low fluency-high flexibility condition, six responses were selected from six different categories. The low fluency-low flexibility condition was composed of six responses from a single category. These responses are presented in Table 1.

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insert Table 1 about here

Each set of responses was modeled during a 90-second episode which was videotaped on a Sony AV-3600 recorder. Thus, in both high fluency

conditions the model emitted a response once every five seconds; in both low fluency conditions, the model verbalized on the basis of a 15-second interval. As the model verbalized in all conditions, he displayed nonverbal "brainstorming" responses in as realistic a fashion as possible. These procedures appeared to be effective since there was no discernable adverse reaction from the children studied. Each videotaped treatment episode was presented on a 22-inch Setchell-Carlson high-resolution monitor.

Procedure

The children were taken in groups of ten to a test room by the experimenter, introduced to the proctor, seated at individual desks, and directed by the experimenter to write their names on the protocols placed before them. Each group was randomly assigned to one of the four experimental conditions.

For all children, the experimenter gave the following instructions: "Today we are going to have a lot of fun playing some guessing games. Listen carefully as I tell you how to play the games. Think of as many possible unusual uses for cardboard boxes as you can. Now here's a man who knows how to play the game very well. Watch and listen." The television monitor was turned on by the experimenter, and the children watched the model display one type of creative behavior.

Immediately after the model performed, all subjects were presented a parallel "unusual uses" task from the Torrance test battery. "Here's the next game. Think of as many possible uses for a tin can as you can, and write them down on the paper in front of you. You will have plenty

of time." The latter instruction was included to minimize the perception of time pressures by the children. During this generalization phase, the children were given five minutes to complete the task. No subjects observed during pilot testing required even this amount of time.

Immediately thereafter, a very different verbal task was administered to all subjects as a stringent measure of generalization. The task termed "Just Suppose" was selected from the Torrance battery, and was introduced as follows: "Here's the next game. Just suppose a great fog were to fall over the earth and all we could see of people would be their feet. What would happen? How would this change life on earth? Write your ideas and guesses down on the paper in front of you." The children were given five minutes to complete the task. At the end of this stringent generalization phase, the children were dismissed and asked not to discuss the games with other children. The teacher was also asked to forestall any discussions among the children about the study until all members of the class had finished. These procedures appeared to effectively preclude any experimental contamination effects.

The test protocols were independently scored by two adults according to the criteria listed in the test manual of Torrance's test. The scorers were kept unaware of the experimental status of each child. The fluency and flexibility scores for generalization and stringent generalization phases that were recorded by each scorer were separately correlated across all subjects. High levels of interscorer reliability were observed. Reliability coefficients for fluency and flexibility for the generalization task were $r = .99$ and $r = .91$, respectively.

The fluency and flexibility measures on stringent generalization task were r = .97 and r = .84, respectively. These findings appeared relatively consistent with the results reported by Torrance (1966).

RESULTS

A 2 x 2 x 2 multivariate analysis of variance model (Morrison, 1967) was used to assess the effects of model fluency, flexibility, and child sex upon the response vector composed of child fluency and flexibility measures at generalization and stringent generalization phases. The dependent measure means for each treatment group are presented in Table 2.

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insert Table 2 about here

Model fluency significantly enhanced children's creative responding in general (F^2 = 3.90, df = 4/109, $p < .005$). Univariate F tests presented in Table 3 revealed that the model's fluency responses significantly enhanced the subject's fluency and flexibility during the generalization phase. The simultaneous increase in both response measures as a function of increases in only the model's fluency indicates the importance of the correlation (r = .70) between these measures. On the stringent generalization task, however, a marginally significant fluency effect was noted on just the child fluency measure ($p < .06$ by one-tailed criteria). This finding indicated that the facilitative influence

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insert Table 3 about here

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of the model's fluency responses generalized to a very differnt type of creative task.

Standardized discriminant function coefficients yielded by the overall multivariate test of the model fluency main effect are presented in Table 4. These weights indicated that 39% of the differences between

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insert Table 4 about here

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the high and low model fluency groups were attributable to child fluency responses during generalization phase performance. This measure was nearly twice as important as any of the other dependent measures in creating the fluency multivariate main effect.

A significant main effect for model flexibility was noted on the student response vector (F^2 = 3.04, df = 4/109, $p < .02$). Contrary to prediction, however, this influence acted to inhibit all types of children's creative behavior as noted in Table 3. The model's diverse categories of response served to significantly depress observer flexibility at both generalization and stringent generalization phases. Perhaps the key to this anomalous finding is suggested in the fluency results. At both generalization and stringent generalization phases, the model's flexibility responses significantly depressed the fluency measures as well. This pattern is particularly evident in Figure 1. Again it appears that the

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insert Figure 1 about here

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high correlation between fluency and flexibility at generalization (r = .70)

and at stringent generalization (r = .84) was more important in predicting response than experimental attempts to manipulate each variable separately. Although contrary in expected direction of influence, model flexibility behavior exerted vicarious influences which even generalized to a substantially different type of creative task.

The discriminant function coefficients yielded by the multivariate main effect for model flexibility indicated that nearly half (49%) of the between-group differences were determined by the child flexibility measure during generalization phase response.

There was a significant interaction between the sex of the child and the model's degree of flexibility (F^2 = 2.44, df = 4/109, $p < .051$). Univariate F tests revealed that this multivariate interaction was created by significant univariate interactions among these independent variables on the child flexibility measure at generalization and stringent generalization phases (see Table 3). A marginally significant interaction was also detected on the child's fluency measure during generalization phase performance. *Post hoc* comparisons of group means involved in the significant univariate interactions were made by Scheffe tests (Kirk, 1968). It was found that girls exposed to the low flexibility model evinced significantly more flexibility than boys who were exposed to high flexibility models at both generalization ($p < .01$) and stringent generalization ($p < .05$) phases. No other *post hoc* comparisons proved significant.

The multivariate interaction of child sex and model flexibility produced a puzzling array of discriminant function coefficients (see

Table 4). The flexibility measure during stringent generalization accounted for the largest amount of the between groups differences (42%). The large negative weight assigned to child fluency during this same phase indicates this measure functioned as a "suppressor" variable. That is, since these dependent measures are so highly intercorrelated and since this particular variable failed to discriminate between the groups (as indicated by the nonsignificant univariate F ratio), the discriminant function equation thus assigned this fluency measure a high negative weight in order to minimize the error variance of the other variables. Scrutiny of Table 4 reveals that the most statistically insignificant variable in each multivariate effect always functioned as the suppressor variable in that discriminant function equation. This overall pattern is also indicative of the importance of the correlation between fluency and flexibility measures and the intractability of these response measures to independent experimental manipulation.

Mimicry (Exact Imitation)

For theoretical reasons, it is important to consider the amount of exact copying, or mimicry, of the model's responses during the generalization phase. It could be argued that parallelism between the Unusual Uses for cardboard boxes task (on which the model performed) and the Unusual Uses for tin cans task (on which the children responded) might have permitted the children to simply reiterate the model's responses. Analysis of the protocols for the children provided contrary evidence. All groups combined emitted only 21 instances of mimicry out of 977 total responses which were emitted, or 2.14%. Consequently, it seems implausible

that the facilitative effect of the model's fluency on the children's fluency response could have resulted from slavish copying of the model's words; instead, it appeared that the model's performance acted as a catalyst or standard which impelled the children to generate more creative responses.

To determine if the experimental treatments differentially produced mimicry, each subject's protocol was scored on the basis of the presence or absence of one or more mimicry responses during imitation phase response. These data are presented in Table 5. A significant relationship between the modeling treatment and the presence of mimicry was noted

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insert Table 5 about here

($\chi^2 = 11.73$, $\underline{df} = 3$, $\underline{p} < .01$). These differences were created primarily by the absence of any mimicry in the low frequency-high flexibility treatment group and the higher degree of mimicry in the high fluency-low flexibility group. It is interesting to note that this comparison directly pits the model fluency and flexibility treatments, with model fluency increasing mimicry and flexibility depressing it.

DISCUSSION

To our knowledge, this is the first evidence that children's creative behavior is amenable to social influence. Not only did the model's performance affect children's response on a parallel task, but it exerted vicarious effects on a substantially different type of creative task. These findings of generalization to highly altered experimental tasks are consistent with those observed in previous vicarious rule-

learning studies (e.g., Zimmerman & Rosenthal, in press; Zimmerman & Pike, in press). These generalization results, considered in concert with the low frequency of exact mimicry of the model's utterances, suggested that the children were responding to the more general characteristics of the model's performance--the tempo and category-shifting qualities--rather than each discrete response.

The low frequency of mimicry has also been observed in vicarious rule learning studies (Rosenthal, Zimmerman, & Durning, 1970). These authors have suggested that unless experimental procedures constrain the imitative response to sheer mimicry, that imitative responses will not conform to the exact topography of the model's response. Instead, the major part of imitative behavior they observed followed the more general properties of the model's behavior, consistent with Bandura's (1969) mediation postulate.

The results produced by the model's degree of flexibility are complex. One interpretation for the inhibiting influence of model flexibility hinges on the high correlation between the children's fluency and flexibility measures. As previously mentioned, Parnes and Meadow (1959) found that the introduction of evaluation during creative problem-solving decreased the number of ideas produced. This decrease in turn produced a diminution in the quality or originality of the ideas generated as a function of the high correlation between these two measures. The present study results appear to be parallel in this regard.

Increases in the diversity of the model's verbal idea display (flexibility) could have made the child more aware of the requirement to

produce dissimilar responses. This vicarious introduction of evaluation into the child's subsequent task performance could be expected to decrease the quantity of ideas generated (fluency measure). Because of high correlation between fluency and flexibility measures in the present study, decreases in fluency would have created decreases in flexibility as well.

The mimicry data appear to support this interpretation as well. Model fluency was found to increase exact imitation, whereas model flexibility completely eliminated it. If an evaluative posture had been vicariously transmitted through model flexibility, it would have inhibited the child from directly copying the model's performance as was observed. This interpretation lends additional support to Osborn's (1957) emphasis on barring evaluation from "brainstorming" activities. It now appears entirely possible that evaluation could be vicariously introduced during "brainstorming" through the flexibility responses of the participants. This interpretation is merely suggestive and invites further research. However, it should be pointed out that these flexibility treatment results were obtained on a free response type of creativity task which was scored on the basis of Torrance's criteria for category definition, and may not generalize to other tasks or definitions.

These results are rather encouraging from a pedagogical point of view. Teachers can increase both the number and diversity of creative ideas generated by their children by exposing them to a highly fluent live or simulated model (presented by film or videotape). Despite the

present paucity of research on this topic, the results suggest that a teacher should become more sensitive to the vicarious influence that her behavior or that of other children has in determining the creative climate of the classroom.

In a recent review of research on creativity, Crockenberg (1972) suggested that educators shift their emphasis from the selecting of creative persons to studying "the conditions or situations, practices or experiences, the approaches and attitudes that are conducive to the production of novel, appropriate, quality ideas" (p.43). This suggestion implies that educational research findings will be more socially useful and relevant to classroom instruction if researchers study the modifiability of creative behavior instead of treating creativity as a relatively permanent intellectual characteristic. This more experimental posture can avoid many of the pitfalls inherent in descriptive correlational approaches, such as treating fluency and flexibility as separate responses.

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FOOTNOTES

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2. All multivariate tests of significance are based on the Wilk's Lambda criterion.

Table 1

Model Responses by Treatment Condition

Treatment Group	Verbal Response
High fluency-high flexibility model:	*to make a doghouse; to make a cat house; to make a chicken house; *to wash dogs in; to wash cats in; to wash rabbits in; *to make a snowflake cutout; to make a doll cutout; to make a flower cutout; *to make a fort; to make a tree house; to make a doll house; *to use as a shopping basket; to use to carry stuff in; to use as a picnic basket; *to make a jewelry box; to make a sand box; to make a gift box.
High fluency-low flexibility model:	*to make earrings; to make a raincoat; to make a hairband; *to make shoulder pads; to make a costume; to make eye-glasses; *to make shoes; to make rings; to make knee pads; *to make Halloween outfits; to make jackets; to make vests; *to make a belt; to make boots; to make a mask; *to make clothing; to make a moustache; to make an Indian headdress.
Low fluency-high flexibility model:	*to make a dog house; *to wash dogs in; *to make a snowflake cutout; *to make a fort; *to use as a shopping basket; *to make a jewelry box.
Low fluency-low flexibility model:	*to make earrings; *to make a raincoat; *too make a hairband; *to make shoulder pads; *to make a costume; *to make eye-glasses.

*"you can use cardboard boxes to..."

Table 2

Dependent Measure Means by Treatment Variations

Observer's behavior by sex group	Model's Behavior			
	High Fluency		Low Fluency	
	High flexibility	Low flexibility	High flexibility	Low flexibility
Males:				
generalization phase:				
fluency	6.87	6.40	9.73	10.18
flexibility	4.27	4.13	5.93	5.41
stringent generalization phase:				
fluency	4.93	3.53	5.00	4.88
flexibility	4.93	2.23	2.73	3.47
Females:				
generalization phase:				
fluency	7.80	6.13	12.00	7.31
flexibility	5.00	3.73	6.80	2.92
stringent generalization phase:				
fluency	4.40	3.60	5.60	3.77
flexibility	3.13	2.20	4.20	1.92

Table 3

Univariate F Tests for each Dependent Measure

Dependent Measure	Effects											
	Fluency				Flexibility				Sex X Flexibility			
	df	F	p< [a]	contrast [b]	df	F	p<	contrast	df	F	p<	contrast
Generalization phase:												
fluency	1/112	14.27	.001	2.99	1/112	3.44	.066	-1.61	1/112	3.58	.06	c
flexibility	1/112	11.05	.001	1.23	1/112	8.90	.003	-1.20	1/112	4.89	.029	c
Stringent Generalization phase:												
fluency	1/112	2.69	.104	.70	1/112	5.19	.025	-1.04	1/112	.40	ns	c
flexibility	1/112	1.12	ns	.35	1/112	4.54	.035	- .85	1/112	3.99	.048	c

[a] All probability levels are based on two-tailed estimates.

[b] The difference is computed by subtracting the mean of the low group from that of the high group.

[c] This contrast was analyzed by post hoc comparison procedures.

Table 4

Standardized Discriminant Function Coefficients

for Significant Treatment Effects

Dependent Measure	Treatment Effects		
	Fluency	Flexibility	Sex X Flexibility
Generalization phase:			
fluency	.69	-.38	.21
flexibility	.37	.96	.47
Stringent generalization phase:			
fluency	.32	.49	-.91
flexibility	-.35	.11	1.16

Table 5

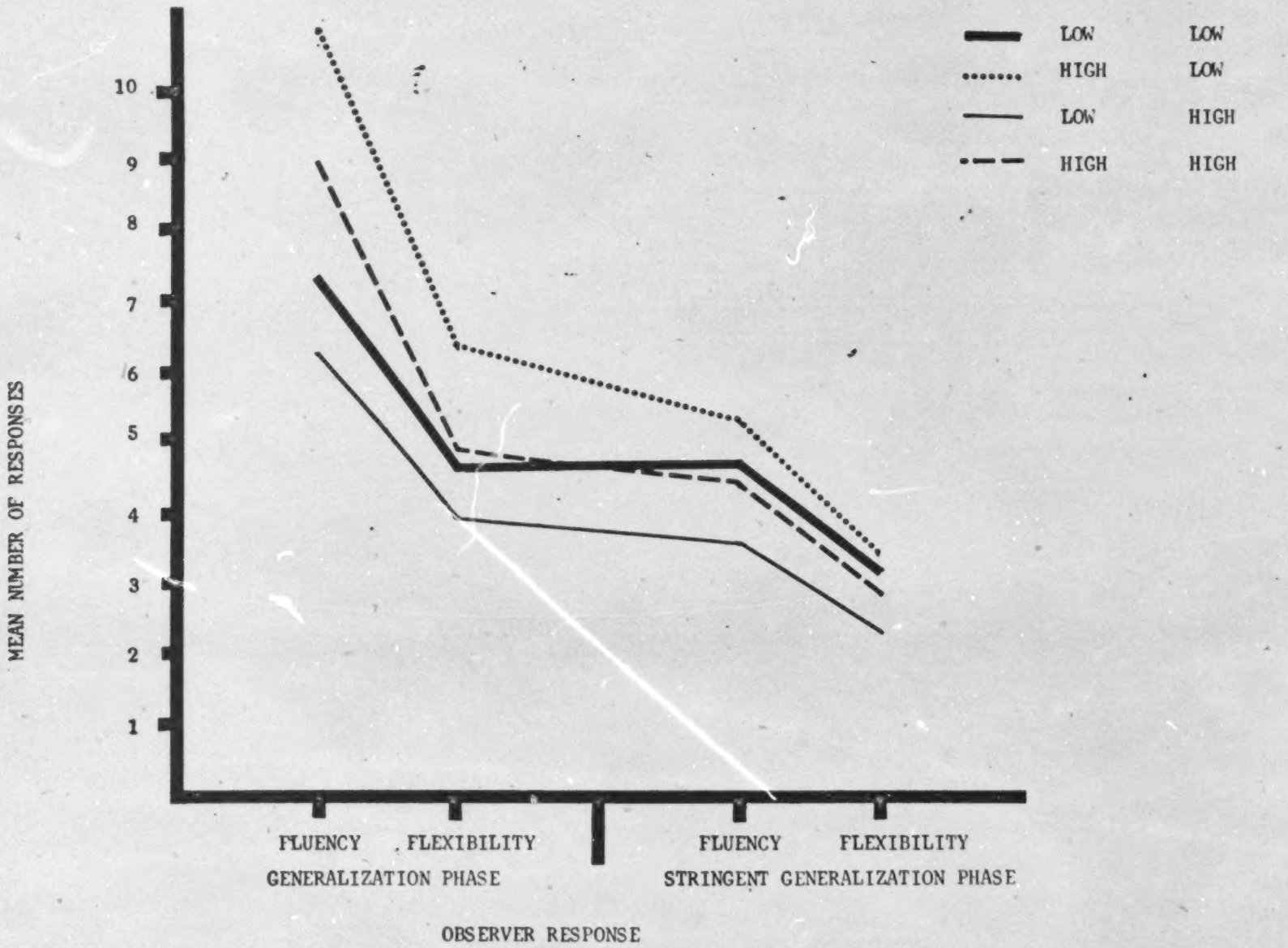
Frequency of Mimicry X Treatment Condition

Child's Classification[a]	Model's Behavior			
	High Fluency		Low Fluency	
	High Flexibility	Low Flexibility	High Flexibility	Low Flexibility
mimics	5	10	0	6
non-mimics	25	20	30	24

[a]Each child who mimicked one or more times was classified as a "mimic". All other children were labeled "non-mimics". These data signify the number of subjects listed according to each label.

Figure Caption

Fig. 1. Dependent measure means for each experimental phase by modeling conditions.


MODEL RESPONSE:
FLUENCY
FLEXIBILITY
LOW
LOW
HIGH
LOW
LOW
HIGH
HIGH
HIGH
MEAN NUMBER OF RESPONSES
10
9
8
7
6
5
4
3
2
1
FLUENCY
FLEXIBILITY
FLUENCY
FLEXIBILITY
GENERALIZATION PHASE
STRINGENT GENERALIZATION PHASE
OBSERVER RESPONSE